Does work-life balance affect pro-environmental behaviour? Evidence for the UK using longitudinal microdata

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Abstract

The environmental challenges we face today have made the need to behave pro-environmentally increasingly salient. Many believe that the modern day "busyness" of life and lack of spare time have kept people from acting according to their values and behaving more pro-environmentally. This study uses microdata from the UK Household Longitudinal Study (UKHLS) to investigate the relation between pro-environmental behaviour, environmental self-perception and work-life balance. Pro-environmental behaviour covers 21 behaviours relating to home energy, personal transport, recycling and shopping. Work-life balance is defined with relation to the availability of discretionary time using both objective and subjective measures. The results from the regression models of overall pro-environmental behaviour suggest that work-life imbalance does not appear to affect, neither directly nor indirectly through environmental values and attitudes, pro-environmental behaviour. The main factors determining the extent of pro-environmental behaviour relate to individual's attitudes towards the environment, age, educational attainment, household income and the presence of young children. The sensitivity analysis looking at differing time demanding behaviours reveals that actual availability of discretionary time does not seem to affect pro-environmental behaviour, while the subjective experience of work-life imbalance can have a negative direct effect particularly for more time demanding pro-environmental behaviours.

Keywords: pro-environmental behaviour; work-life balance; environmental attitudes; longitudinal microdata

JEL codes: C83, D10, Q50

1. Introduction

The tremendous environmental challenges we face today have made the need to behave pro-environmentally increasingly salient for individuals. However, existing evidence suggests that having environmental concerns and a pro-environmental attitude do not necessarily lead to pro-environmental behaviour (Stern, 2000, Whitmarsh, 2009). There seems to exist a gap between people's pro-environmental values and their behaviour, which is called the attitude-behaviour gap or the value-action gap (Kollmuss and Agyeman, 2002, Kennedy et al., 2009). Many believe that our modern day hectic lifestyle is to blame and argue that the "busyness" of life and the lack of spare time have kept people from acting according to their values and adopting a more pro-environmental lifestyle (e.g. Thøgersen, 2005, McDonald et al., 2006, Chai et al., 2015). Moreover, not only has the time spent on work and leisure become increasingly imbalanced, the subjective perception of time pressure and work-life imbalance has also increased, with growing numbers of people reporting they feel burned out from work (Peeters et al., 2005).

Empirical findings are mixed regarding pro-environmental attitudes and behaviour. Using a survey of the UK public, Whitmarsh and O'Neill (2010) show that environmental self-identity is a significant determinant of carbon offsetting behaviour, but not other types of pro-environmental behaviour. Barr (2007) used a self-report questionnaire of UK residents and found that pro-environmental values are a significant predictor of waste reduction and reuse, but not of recycling. Moreover, researchers often find a gap between the pro-environmental attitudes and behaviours. In a nationwide survey in Canada, 72% of respondents self-reported a gap between their pro-environmental intentions and actions (Kennedy et al., 2009). Chung and Leung (2007) reported a gap between verbal commitment and corresponding behaviour in waste recycling among undergraduates on university campus in Hong Kong. Newton and Meyer (2013) found in a survey of residents in Melbourne, Australia, that people who hold different environmental attitudes display few differences in actual consumption of energy, water, housing space etc. Valkila and Saari (2013) studied home energy and travel behaviours in three Finnish areas, and found that there is a gap between people's attitude towards the environment and their actual behaviour. Attitude has become greener, but actual behaviour is changing more slowly.

The cause of the value-action gap is still unclear (Kollmuss and Agyeman, 2002). Self-perception theory (Bem, 1972) suggests that to some extent (i.e. in the absence of coherently structured attitudes) people come to understand their own attitudes and other internal states like values, by inferring them from their behaviour(s). Through this process, people's attitudes and behaviours would be expected to become gradually more consistent over time. However, in everyday life, situational factors often make it hard for people to act in a manner consistent with their attitudes. Some suggest that the lack of a better work-life balance is one of the reasons people fail to act according to their values (Thøgersen, 2005, McDonald et al., 2006). Work-life balance may also directly affect environmental behaviour through objective time scarcity - the amount of unallocated time (i.e. not spent on work, commuting and housework) an individual has - if pro-environmental activities require more time to perform than their less pro-environmental alternatives. Becker (1965) first developed a theoretical framework in which he demonstrated how the existence of a time constraint and time component of activities affect behaviour. The framework has since been used in household economics to include the time component in decision making. It predicted that if

activities require more time to perform, then the less total unallocated time one has, the less of those activities one is likely to do. In the context of our study, the hypothesis is that choosing to carry out a pro-environmental behaviour, compared to the conventional alternative, may require greater time commitment in terms of the mental time (effort) and/or the objective time (i.e. physical time) it requires. To illustrate this idea, consider how overworking may affect the choice of mode of travel to work for short commuting distances (2-3 miles). The more pro-environmental option would be to walk or cycle to work, however, individuals experiencing work-related time pressure and/or feelings of 'busyness' may be more predisposed to drive their car to work in order to gain time. Consequently, work-life imbalance may influence people's ability to engage in pro-environmental behaviours, even if they share pro-environmental values and concerns. On the other hand, however, individuals with greater discretionary time may decide to spend it on activities with higher carbon footprint (Binswanger, 2006, Brenčič and Young, 2009, Druckman et al., 2012, Knight et al., 2013). As a result, it is difficult to predict in a clear-cut way if, and how, work-life balance will impact pro-environmental behaviour. Moreover, its effect, if any, may play out differently across behaviours depending on how 'time demanding' they are perceived to be.

There is very limited evidence on the direct and indirect (i.e. the value-action gap) effects of increased discretionary time and better work-life balance on the uptake of pro-environmental behaviours. A recent study by Chai et al. (2015), who tested this relationship using data for 3,096 Australian citizens collected through a web-based survey in 2010, found that increasing discretionary time is associated with a significant reduction in the value-action gap. However, on that study the authors used employment status (e.g. full-time, part-time, unemployed, retired) as a proxy for discretionary time, which is a rather crude measure of time scarcity and work-life balance. The present study investigates the effect of discretionary time, defined both in an objective and subjective way, on pro-environmental behaviours using data from the UK Household Longitudinal Study (UKHLS) for 2009/2010 and 2012/2013. We use microdata on households and individuals to empirically test and quantify the relationship between work-life balance, environmental self-perception and pro-environmental behaviour. We improve on the work carried out by Chai et al. (2015) by constructing more accurate measures of work-life balance, which capture both the objective amount of leisure (i.e. unallocated) time available and individuals' subjective satisfaction with the amount of available leisure time. We attempt to distinguish between objective and perceived (i.e. subjective) time scarcity, as some may argue that it is not the actual, but the perceived lack of time that affects people's behaviour and quality of life (Peters and van der Lippe, 2007).

We find a strong relationship between environmental self-perception and pro-environmental behaviour. Differences in individual and household socio-economic and demographic attributes also help explain the variation in pro-environmental behaviour. However, we do not find a statistically significant relationship between work-life imbalance and pro-environmental behaviour: that is, working too many hours and feeling dissatisfied with the amount of discretionary time does not appear to be a significant factor determining individuals' pro-environmental behaviour. Furthermore, work-life imbalance does not appear to act as a moderator of the relationship between environmental self-perception and pro-environmental behaviour. In other words, the value-action gap, if any, does not appear to be a result of lack of (free) time per se. Neither "being

busy" (objective work-life imbalance) nor "feeling busy" (subjective work-life imbalance) is found to be associated with an increase in the gap between the pro-environmental behaviour an individual engages in and his/her environmental self-perception. Nonetheless, the sensitivity analysis revealed that "feeling busy" (i.e. subjective work-life balance) can have impact negatively the uptake of pro-environmental behaviour, particularly so for more time demanding pro-environmental behaviours. In contrast, the actual availability of discretionary time did not seem to influence pro-environmental behaviour.

The rest of the paper proceeds as follows. Section 2 describes the theoretical framework that provides a context for our empirical analysis and hypotheses. Section 3 describes the empirical methodology and the two measures of pro-environmental behaviour. Section 4 presents the data and descriptive statistics. Section 5 presents the results and discussion. Finally, Section 6 concludes.

2. Theoretical Framework

In this section, we propose a theoretical framework that links work-life balance, environmental values and pro-environmental behaviour, and environmental self-perception. Figure 1 illustrates the framework that links these concepts and relationships. In particular, we will study the following three relationships:

1. Work-life balance (objective and subjective) and pro-environmental behaviour (relationship 1).

Objective work-life balance is related to the economic concept of time constraint or time scarcity. Since the amount of time available to people is fixed, economic theory predicts that the less discretionary time a person has, the less time she will allocate to carry out pro-environmental activities that take longer than non-pro-environmental activities (e.g. walking or cycling to work instead of driving, separating waste for recycling instead of using general waste bin). In this study, we measure objective work-life balance by the unallocated free time a person has in a day (time not spent on work, commuting or housework). It is not only physical time, or rather the lack of it, that can influence people's ability to engage in sustainable lifestyles, but also the subjective feeling of being under time pressure and the lack of an optimal work-life balance. Subjective work-life balance is related to the psychological concept of cognitive constraint, which proposes that people have limited cognitive resources. The perception of not having enough discretionary time to complete a set of desired tasks puts a strain on people's cognitive resources, which we hypothesise leaves them less likely to engage in pro-environment behaviours.

2. Environmental values and pro-environmental behaviour (relationship 2).

Part of the reason why people carry out pro-environmental activities is their values and attitudes towards the (natural) environment and the extent to which they perceive their lifestyles to positively impact on it. However, evidence on the existence of a value-action gap suggests that pro-environmental attitudes and values are not necessarily good predictors of pro-environmental behaviour as other influencing factors affect the ability of people to behave according to their values. In this study, we attempt to capture individuals' general pro-environmental attitudes or values with a measure of an individuals' environmental self-perception regarding their lifestyle and behaviours.

We believe this is a reasonable approach on the grounds that people generally strive to live in a manner consistent with their values and the fact that they tend to base their identity on past action and in turn let their identity guide their actions.

3. Work-life balance acts as a moderator for relationship 2 between environmental self-perception and pro-environmental behaviour (relationship 3).

This is an interaction term that we employ to investigate if, and how, work-life balance affects the value-action gap. If the lack of work-life balance is (part of) the reason people fail to act according to their pro-environmental values, the gap between pro-environmental values and pro-environmental behaviour will become bigger the greater the degree of work-life imbalance.

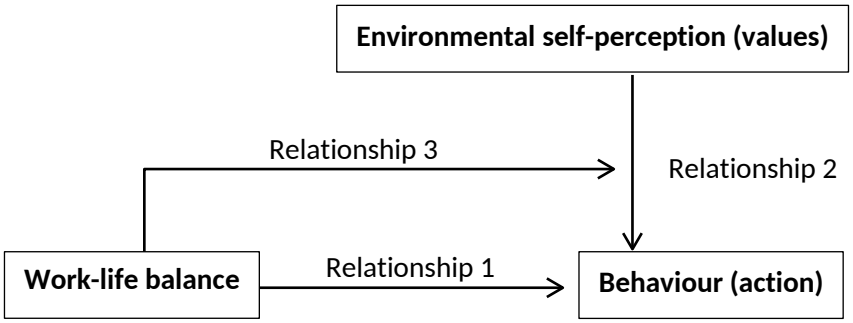

Figure 1. Conceptual framework for pro-environmental behaviour and work-life balance

3. Methodology

3.1. Measuring pro-environmental behaviour (PEB)

Two composite indices of pro-environmental behaviour were developed covering 21 individual activities relating to home energy, personal transport, recycling and shopping. Table 1 summarises the environmental behaviours identified in the UKHLS. The list includes a wide range of behaviours spanning across various domains (e.g. home energy, recycling, personal transport, etc.), and includes both habitual vs. one-off actions and low vs. high environmental impact actions.

Table 1. List of environmental behaviours

Behaviour	Domain	Behaviour type
Leave your TV on standby for the night[1,2]	Home energy	Habitual, low impact
Switch off lights in rooms that aren't being used[1,2]	Home energy	Habitual, low impact
Put more clothes on when you feel cold rather than putting the heating on or turning it up[1,2]	Home energy	Habitual, low impact
Keep the tap running while you brush your teeth[1,2]	Home energy	Habitual, low impact
Have you installed or are you seriously considering installing solar panels for electricity?[3]	Home energy	One-off, high impact
Have you installed or are you seriously considering installing solar water heating?[3]	Home energy	One-off, high impact
Have you installed or are you seriously considering installing wind turbine to generate electricity?[3]	Home energy	One-off, high impact
Does your household buy or is seriously considering buying its electricity on a Green Tariff? [3]	Home energy	One-off, high impact
Use public transport (e.g. bus, train) rather than travel by car (all journeys)[2]	Personal transport	Habitual, high impact
Walk or cycle for short journeys less than 2 or 3 miles[1,2]	Personal transport	Habitual, high impact
Car share with others who need to make a similar journey[2]	Personal transport	Habitual, low impact
Take fewer flights when possible[1,2]	Personal transport	Variable regularity, high impact
Mode of transport to work[4]	Personal transport	Habitual, high impact
Separate items for recycling[5]	Recycling	Habitual, low-medium impact
Frequency of using bottle bank[6]	Recycling	Habitual, low-medium impact
Frequency of using paper recycling point[6]	Recycling	Habitual, low-medium impact
Frequency of using plastic bag recycling point[6]	Recycling	Habitual, low-medium impact
Frequency of using garden waste recycling facility[6]	Recycling	Habitual, low-medium impact
Decide not to buy something because you feel it has too much packaging[1,2]	Shopping	Habitual, low-medium impact
Buy recycled paper products such as toilet paper or tissues[1,2]	Shopping	Habitual, low-medium impact
Take your own shopping bag when shopping[1,2]	Shopping	Habitual, low-medium impact

[1] Adapted from DEFRA (2008).
[2] Response: always (1), very often (2), quite often (3), not very often (4), never (5), can't do this/not applicable (6).
[3] Response: yes we already buy (1), yes we are seriously considering (2), no (3), considered in past and rejected (4).
[4] Response grouped into: private transport, including getting lifts (1), public transport (2), active travel (3), work from home (4).
[5] Response: always (1), usually (2), sometimes (3), never (4), no recycling facilities, use normal rubbish collection (5).
[6] Response: very often (1), fairly often (2), not very often (3), never (4), no recycling facility in area (5).

We consider two different approaches to produce an index of pro-environmental behaviour (PEB): (i) a naïve PEB index, and (ii) a Graded Response Model (GRM) PEB index. Variations on the first approach have been used in previous studies (e.g. Longhi, 2013, Lynn, 2014). The main advantage of the naïve index is its relative simplicity of computation and interpretation; its two main limitations are (a) that it attributes equal weight to all behaviours irrespective of their difficulty and environmental impact, and (b) that as a simple summation/averaging method, ordinal scale variables must be arbitrarily assigned numerical scores. The second approach, based on a GRM, overcomes these limitations but is considerably more complex in computation. The two indices are explained below.

3.1.1 The Naïve PEB index

In order to calculate a pro-environmental behaviour index based on the simple aggregation of individual behaviours, we first recode the variables in Table 1 such that higher values correspond to more pro-environmental behaviours. The 21 behaviours shown in Table 1 are assessed by ordinal scale variables, but with differing numbers of categories: 11 have 5 categories, with assigned integer values 0 to 4 (and these variables relate to regular home energy behaviours, personal transport behaviours except commuting mode, and shopping related behaviours); 6 have 4 categories with values ranging from 0 to 3 (commuting mode and recycling behaviours), and 4 have just 3 categories with values from 0 to 2 (one-off home energy behaviours). To account for the three different scales we divide each response by the maximum possible score for the given question (e.g. a score of 2 in a question with scores ranging from 0 to 4 would result in a scaled score equal to 2/4=0.5). To obtain an overall index of pro-environmental behaviour we then take the mean of these scaled scores across all environmental behaviours for each individual. The resulting pro-environmental behaviour index therefore is contained within the interval 0 to 1. The naïve pro-environmental behaviour index has a mean/median equal to 0.38/0.38 in wave 1 (2009/10) and 0.36/0.36 in wave 4 (2012/13). Figure 2 shows the distribution of the naive pro-environmental behaviour index for wave 1 (left panel) and wave 4 (right panel).

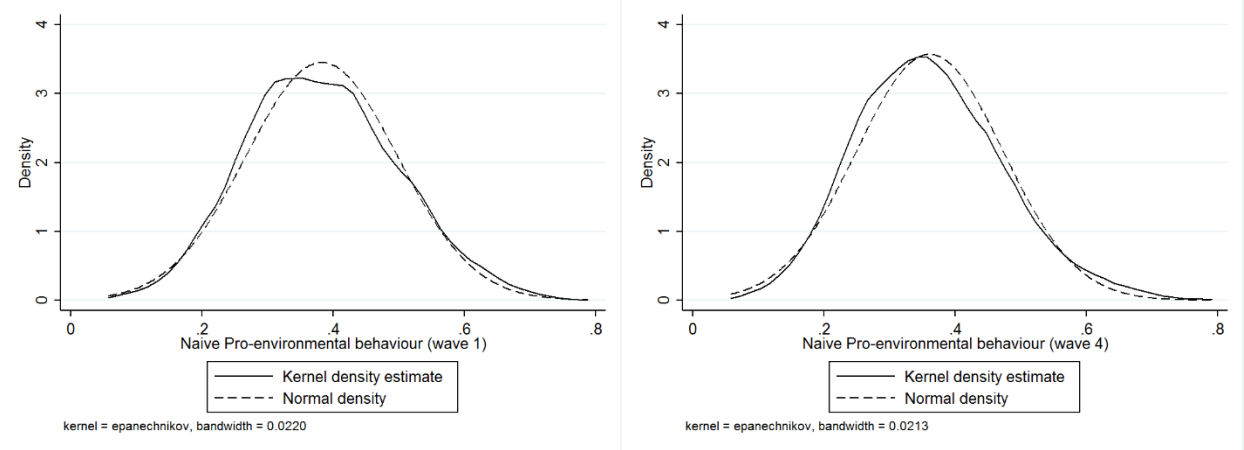

Figure 2. Distribution of the naive PEB index: wave 1 (left) and wave 4 (right)

3.1.2 Graded Response Model PEB index

Latent variable models (Galbraith et al., 2008) are a class of models which are, in essence, multivariate regression models linking continuous or categorical responses to unobserved (or *latent*) explanatory variables. Item Response Theory (IRT) models (Baker and Kim, 2004) are a sub-class of latent variable models where the response variables are generally categorical only, and which have been used commonly in educational testing (e.g. Lord, 1980) where the aim is to rate an individual's overall academic ability (itself a latent variable) from a suite of test scores. Refining the class still further, the Graded Response Model (GRM; (Samejima, 1968)) is a type of IRT model where the response variables are ordinal, i.e. ordered categorical. The Partial Credit Model (PCM; (Masters, 1982) is another IRT model suitable for ordinal measurements; however, as we have ordinal scales with differing numbers of classes and do not wish to assume that differences between response categories are identical for different behaviours, the GRM is the most appropriate for our analysis (Rizopoulos, 2006).

The GRM approach has the advantage over the naïve approach of relaxing the assumption of equal weighting (i.e. importance) across the 21 environmental behaviours. The GRM index is derived from coefficients which weight individual behaviours based on their ability to rate peoples' overall environmental behaviour based on whether they perform, or do not perform, certain behaviours. Table 2 shows the loadings (or coefficients) from the GRM; in some sense, the absolute values of these loadings could be regarded as "weights". For example, the frequency with which people use paper recycling facilities contributes a large weight (indicated by the large, positive loading) towards the overall PEB index because it is a good indicator of pro-environmental behaviour within our data set – in other words there is a decent spread of people across the four categories for this variable. On the other hand, as an example, switching off lights in rooms that are not being used seems to contribute little to the overall PEB index as most people seem to do this in any case and the variable does not correlate well with pro-environmental behaviour indicated by other variables.

Table 2. Loadings used in the calculation of the GRM PEB index

Behaviour	Loading
Leave your TV on standby for the night	0.12
Switch off lights in rooms that aren't being used	0.10
Keep the tap running while you brush your teeth	0.16
Put more clothes on when you feel cold rather than putting the heating on or turning it up	0.14
Have you installed or are you seriously considering installing solar panels for electricity	0.34
Have you installed or are you seriously considering installing solar water heating	0.43
Have you installed or are you seriously considering installing wind turbine to generate electricity	0.56
Does your household buy or is seriously considering buying its electricity on a Green Tariff?	0.41
Use public transport (e.g. bus, train) rather than travel by car	0.04
Walk or cycle for short journeys less than 2 or 3 miles	0.09
Car share with others who need to make a similar journey	0.11
Take fewer flights when possible	0.30
Mode of transport to work	0.00
Separate items for recycling	0.41
Frequency of using bottle bank	3.02
Frequency of using paper recycling point	4.63
Frequency of using plastic bag recycling point	1.72
Frequency of using garden waste recycling facility	1.46
Decide not to buy something because you feel it has too much packaging	0.31
Buy recycled paper products such as toilet paper or tissues	0.29
Take your own shopping bag when shopping	0.30

Figure 3 shows the distribution of the GRM-derived index of pro-environmental behaviour. The index has been normalized such that it ranges between 0 and 1, like the naïve pro-environmental behaviour index. The index has a mean/median equal to 0.40/0.39 in wave 1 (2009/10) and 0.37/0.34 in wave 4 (2012/13). The pairwise correlation between the Naïve and GRM pro-environmental behaviour indices is equal to 0.73 in wave 1 and 0.72 in wave 4, and is statistically significantly different from zero in both waves.

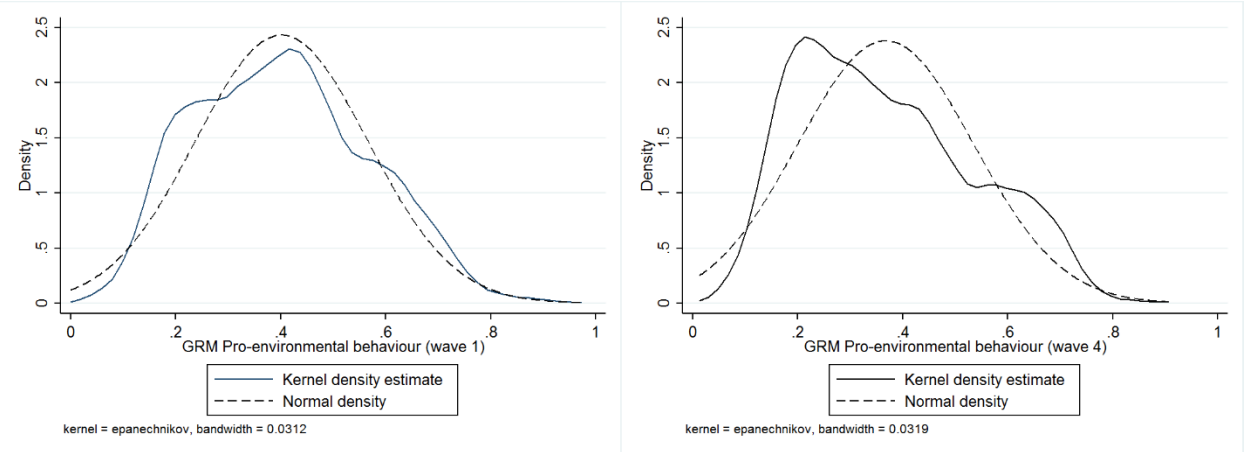

Figure 3. Distribution of the GRM PEB index: wave 1 (left) and wave 4 (right)

3.2. Regression models

To investigate the relationship between pro-environmental behaviour and the different factors affecting it, particularly work-life imbalance, we estimate multiple regression models using individual level data for two waves of the UKHLS. Given our derived indices of PEB, we developed linear regression models to estimate the relationship between pro-environmental behaviour and the different factors which might affect it, including: demographic and socio-economic attributes of individuals and their respective households; household residential location-specific factors which might constrain or facilitate the adoption of pro-environmental behaviour; individual's environmental self-perception; and the objective and subjective measures of work-life balance. These variables are described in detail in section 4.

The regression analysis of pro-environmental behaviour is organised in two parts, one for each index of PEB: the naïve PEB index, and the GRM PEB index. The fully specified model can be described in general terms as follows:

$$PEB_{i,t} = f\left(X_{i,t}, X_{h(i),t}, HL_{h,t}, EA_{i,t}, sWLB_{i,t}, oWLB_{i,t}\right) \quad (1)$$

where *i* identifies the individual, *h* identifies the individual's household, and *t* identifies the wave (i.e. wave 1, wave 4). The variables in equation (1) are summarised below:

$PEB_{i,t}$ = individual *i* pro-environmental behaviour at time *t*

$X_{i,t}$ = demographic and socio-economic attributes of individual *i* at time *t*

$X_{h(i),t}$ = demographic and socio-economic attributes individual's *i* household *h* at time *t*

$HL_{i,t}$ = household *h* location factors at time *t*

$EA_{i,t}$ = environmental self-perception of individual *i* at time *t*

$sWLB_{i,t}$ = subjective measure of work-life balance of individual *i* at time *t*

$oWLB_{i,t}$ = objective measure of work-life balance of individual *i* at time *t*

Individuals living with other people in the same household, particularly those in a relationship, are likely to affect each other's decisions and behaviours. Therefore, individual's pro-environmental behaviour may be (partially) determined by partner's pro-environmental behaviour. To allow for the presence of intra-household peer effects we estimate a version of equation (1) including partner's pro-environmental behaviour ($PEB^{i'}_{i,t}$) as an additional covariate, as described in the following equation (2) below.

$$PEB_{i,t} = f\left(X_{i,t}, X_{h(i),t}, HL_{h,t}, EA_{i,t}, sWLB_{i,t}, oWLB_{i,t}, PEB^{i'}_{i,t}\right) \quad (2)$$

Finally, to investigate if, and how, work-life balance moderates the relationship between environmental self-perception and pro-environmental behaviour, we also consider a version of the model in equation (1) with interaction terms between environmental self-perception and both the objective and subjective measures of work-life balance, as illustrated in equation (3) below. The hypothesis is that increased feelings of 'busyness' and time scarcity may weaken the relationship between environmental self-perception and pro-environmental behaviour because individuals feel more cognitively depleted and less able to act according to their (pro-environmental) values.

$$PEB_{i,t} = f\left(X_{i,t}, X_{h(i),t}, HL_{h,t}, EA_{i,t}, sWLB_{i,t}, oWLB_{i,t}, EA_{i,t} \times sWLB_{i,t}, EA_{i,t} \times oWLB_{i,t}\right) \quad (3)$$

The data available at the time of this study covered only two waves, therefore we cannot implement panel data type estimators (e.g. individual fixed-effects estimators), which would help capture possible unobservable time-invariant heterogeneity across individuals. Therefore, we used ordinary least squares (OLS) estimator, allowing for correlation of the observations at the household level.

3.3. Sensitivity Analysis

As discussed earlier, the moderator effect of work-life balance on the relationship between environmental self-perception and pro-environmental behaviour (if present) may vary depending on the individual behaviour being considered because pro-environmental behaviours have different time requirements (perceived or actual). Therefore, we also carried out a sensitivity analysis using the most and least time demanding behaviours from our list of 21 individual pro-environmental behaviours in Table, respectively: 'Walk or cycle for short journeys less than 2 or 3 miles' and 'Take your own shopping bag when shopping'. The results are discussed in section 5.2.

4. Data

This study uses data from the new UK Household Longitudinal Study (UKHLS), also known as 'Understanding Society' (University of Essex. Institute for Social and Economic Research. NatCen Social Research, 2014a, 2014b). This is a large multipurpose annual longitudinal survey which collects data for individuals and households. At the time of this study, data were available for the first four waves of the survey, covering the period from 2009/2010 to 2012/2013. The survey contains a series of modules (some of which are applied on a rotating basis) including a wide range of topics referring to individual and household demographics, socio-economics, health and well-being, personal transport, consumption and housing expenditure, and environmental attitudes and behaviours, among other topics. For the purpose of this study, we are interested in the data relevant for the theoretical framework described in section 2, namely: environmental self-perception, environmental behaviours, work-life balance, and the demographic and socio-economic characteristics of individuals and their households.

Although the UKHLS is longitudinal in nature, the questions in the rotated modules are not asked annually – this is the case of the modules referring to environmental attitudes and behaviours,

which have so far been included only in waves 1 and 4. Therefore, for the purpose of this study we will consider data for these two waves only, which cover the periods 2009/2010 and 2012/2013. Moreover, the empirical analysis considers only the sample individuals in employment, thus excluding students, retirees, and the unemployed from the analysis. The reason underlying the restriction of the sample studied is that we cannot properly estimate the measure of objective work-life balance for students, retirees, and the unemployed. For example, it is not possible to know how unemployed individuals spend their time, which may include any of multiple activities from compulsory training, volunteering, leisure, etc. Similarly, it is very difficult to estimate how retirees use their time, which can also include multiple activities including unpaid work. We discuss the different sets of variables used in this study in the following sub-sections.

Individual and household demographic and socio-economic attributes

The UKHLS provides a rich set of data for individual and household demographic and socio-economic attributes, including: age, gender, marital status, highest qualification attained, employment status and regime, income, occupational and industrial affiliation, number and age of children in the household. Table 3 provides a summary of the demographic and socio-economic variables for the sample used in our analysis (both waves were pooled together).

Table 3. Summary of demographic and socio-economic variables (N=4,465)

Variables	Observations	%
Age group		
15-24	180	4.0%
25-34	958	21.5%
35-44	1394	31.2%
45-54	1220	27.3%
55-64	645	14.4%
64+	68	1.5%
Female	2485	55.7%
Part-time	1006	22.5%
Highest level of qualifications		
Higher education degree	1562	35.0%
Other higher education qualification	654	14.6%
A levels	858	19.2%
GSCEs	883	19.8%
Other qualification	313	7.0%
No qualification	195	4.4%
Household type		
Single, no children	494	11.1%
Single, children 0-5	16	0.4%
Single, children 5-15	173	3.9%
Couple/adults, no children	1962	43.9%
Couple/adults, children 0-5	455	10.2%
Couple/adults, children 5-15	1365	30.6%

Variables	Observations	%
Household residential location		
Urban	3483	78.0%
Small town	420	9.4%
Village, rural	562	12.6%

Residential location context

Household residential location may also affect the individual pro-environmental behaviour to the extent it may constrain or facilitate the adoption of pro-environmental behaviour. For example, differences in the availability of local infrastructure and practices regarding recycling, transport and urban mobility may influence behaviours. Unfortunately it is very difficult to find data to measure these differences across household locations. We attempt to capture for part of this variation by including control variables for Local Authorities (LAs) and the degree of urbanisation/rurality of households residential place (i.e. whether households live in rural area, small town, or urban area). Admittedly, however, there may be additional sources of spatial heterogeneity we do not control for.

Environmental self-perception

In the absence of an appropriate measure for environmental self-identity, such as the measure used by Whitmarsh and O'Neill (2010), which asked people to indicate the extent to which they considered themselves as having an environmental lifestyle, we use a measure based on individual's self-perception (Bem, 1972) about their lifestyle and the environment. Whilst this is similar (and overlapping) as a construct it is necessarily restricted to self-perceptions related to overt behaviour. Previous studies have assessed environmental self-perception at the general level with questions such as "I think my behaviour is environmentally responsible" (Cornelissen et al., 2008, p. 50). The options available are that the individual perceives himself as (i) doing nothing or 1-2 environmentally friendly activities (45%), (ii) doing quite a few environmentally friendly activities (43%), and (iii) doing most things or everything in an environmentally friendly fashion (12%). The pairwise correlations between this measure of environmental self-perception and the naïve and GRM indices of pro-environmental behaviour are 0.31 and 0.14 respectively.

Work-life balance

Existing studies on work-life balance have conceptualised, and measured, imbalance in terms of the long hours of paid work (e.g. White et al., 2003, Fagan et al., 2012). This approach is convenient because it gives an objective measure of the (little) time left to engage in activities pertaining to other dimensions of life (e.g. family, friends, community groups). Where possible this more direct time-based measure of work-life balance has been combined with more subjective measures based on individuals' perceived level of satisfaction with the balance between work/non-work activities and/or the degree of satisfaction with the amount of time for non-work activities (e.g. leisure).

We adopt a similar approach using both objective (i.e. with reference to time) and more subjective measures of work-life balance. The objective measure is obtained by calculating the daily share of 'unallocated' time. Unallocated time is derived by subtracting from 24 hours the amount of hours individuals spend on: sleep, work (including overtime), door-to-door travel-to-work time, and housework chores. This improves considerably on measures used in previous studies to capture 'discretionary' time, based on whether an individual works full-time, part-time, or is unemployed, retired, or a student (e.g. Chai et al., 2015). However, due to many missing values for housework hours in wave 1 we could only compute the daily share of 'unallocated' time for about one quarter of the observations in wave 1. The pairwise correlations between this measure and the naïve and GRM indices of pro-environmental behaviour are 0.006 and -0.025, respectively, and are not statistically significantly different from zero in either case.

Unfortunately, the UKHLS does not ask individuals a direct question about 'feeling under time pressure' or 'feeling unhappy about the balance between work and non-work (family, social, etc.) aspects of life'. Therefore, we need to rely on indirect proxy measures that can capture partially the subjective experience of feeling time-squeezed and unhappy about the balance between work/non-work activities. The best candidate variable is based on respondents' feeling of satisfaction with the amount of leisure time ("How satisfied do you feel with the amount of leisure time?"), where satisfaction is measured on a 7-point scale ranging from 'completely satisfied' to 'completely dissatisfied'.[1] We rank the variable such that higher scores mean greater dissatisfaction with the amount of leisure time. The pairwise correlations between this more subjective measure of work-life balance and the naïve and GRM indices of pro-environmental behaviour are -0.024 and -0.009, respectively, and neither are statistically significantly different from zero. The pairwise correlation between the objective and subjective measures of work-life balance is small and equal to -0.085: it suggests that greater amounts of 'unallocated' time (i.e. spent in non-paid work activities) are not associated with greater levels of satisfaction with leisure time, but the effect is very small and statistically indistinguishable from zero.

Intra-household peer effects

As noted in section 3.2 above (i.e. equation (2)), we investigate the presence of intra-household peer effects by testing if individuals living in the same household as a couple (i.e. partners) affect each other's pro-environmental behaviour. Figure 4 shows the scatter plot of the pro-environmental behaviour index for both partners (in households with couples) using the Naïve (left panel) and GRM (right panel) approach. The coefficient of pairwise correlation between partners' pro-environmental behaviour is 0.74 for the naïve PEB index and 0.99 for the GRM PEB index. Interestingly, both figure 4 and the coefficients of pairwise correlation suggest that the positive association between partners' pro-environmental behaviour is considerably stronger in the case of the GRM PEB index.

[1] 'Completely satisfied', 'mostly satisfied', 'somewhat satisfied', 'neither dissatisfied/satisfied', 'somewhat dissatisfied', 'mostly dissatisfied', 'completely dissatisfied'.

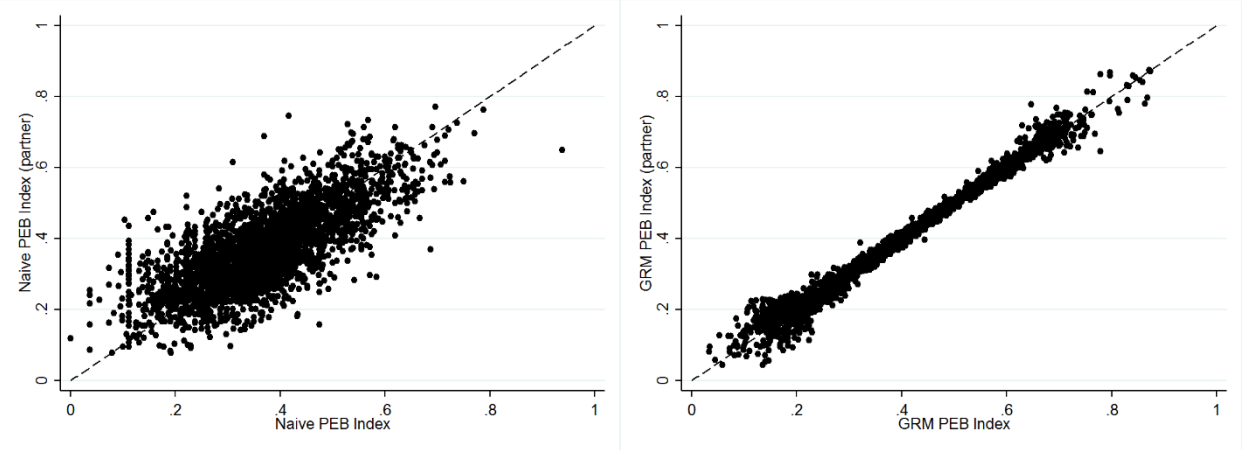

Figure 4. Scatter plot of partners' Naïve PEB index (left) and GRM PEB index (right)

5. Results and discussion

5.1. Summary of main findings

This section discusses the results of the regression analyses specified for the naïve and GRM indices of pro-environmental behaviour in Table 4 and Table 5, respectively. We consider five model specifications, starting with a simple model (1) including only individual and household attributes and household location. We then add the measure for environmental self-perception in model (2), the objective and subjective measures of work-life balance in model (3), and the interactions between environmental self-perception and the objective and subjective measures of work-life balance in model (4). Finally, we examine the presence and importance of intra-household effects by adding the partner's pro-environmental behaviour index in model (5) to the specification of model (3). Overall, the goodness of fit of the models is very reasonable given that we only have data for two points in time. The adjusted coefficient of determination (R^2) ranges between 0.20-0.60 for the naïve PEB index models and 0.28-0.98 for the GRM PEB index models.

With regards to the main research question studied in this work - i.e. whether (objective and/or subjective) work-life imbalance affect the relation between one's attitudes towards the environment (i.e. environmental self-perception) and reported pro-environmental behaviour-, the results suggest this does not appear to be the case. In contrast, the analysis suggests that some individual and household demographic and socio-economic attributes (e.g. age, education, income) and individual environmental self-perception play a strong role in explaining differences in individuals' reported pro-environmental behaviour. We discuss these results in greater detail in the following paragraphs.

Work-life balance, environmental self-perception and pro-environmental behaviour

Model (3) includes the subjective and objective measures of work-life balance, while model (4) interacts these variables with the measure for environmental self-perception in order to test for a moderator effect of work-life balance on the relationship between environmental self-perception and pro-environmental behaviour.

As explained earlier in the paper, objective work-life balance is represented by the amount of 'unallocated' time (i.e. supposedly free time), while subjective work-life balance is measured by the self-reported degree of satisfaction with the amount of leisure time. Technically, the latter is an ordinal (ordered categorical) variable with varying degrees of satisfaction on a scale ranging from 'completely satisfied' to 'completely dissatisfied'. We consider two possibilities for including such a variable as a predictor: firstly by fitting it as a factor, and secondly by assigning consecutive integers to the ordered levels and fitting it as continuous (i.e. as a linear term). The first option ignores the ordering, but the second may be too simplistic; hence we have carried out a Likelihood Ratio (LR) test to evaluate whether it is appropriate to consider this variable as continuous. To do this we specified an 'enlarged' version of the model using both a linear and a factor term for the same variable. This is, in effect, modelling a linear relationship and allowing for variation around that line, via the factor. We compare the enlarged model with a simpler version including only a linear term and run a LR test to assess if the factor term provides a significant improvement to the model. Here, the LR test fails to reject the null hypothesis (namely, the factor term does not improve the model) suggesting that the simpler model specifying the subjective measure of work-life balance using a linear (continuous) trend is appropriate.

The results obtained from models (3) and (4) for both the naïve index (in Table 4) and GRM index (in Table 5) suggest that work-life balance does not appear to impact on pro-environmental behaviour neither directly (i.e. model (3)) nor indirectly through interactions with environmental self-perception (i.e. model (4)). This appears to be the case for both the subjective and objective measures of work-life balance. Our findings do not support the hypothesis that increased feelings of time squeeze and work-life imbalance affect (negatively) the intentions of environmentally minded individuals to behave pro-environmentally. In fact, the model fit as measured by the adjusted coefficient of determination does not improve when we add the variables for objective and subjective work-life balance in model (3) and model (4). It seems that working 'too many' hours (objective measure) does not help explain variability in the pro-environmental behaviour index. We also experimented using a quadratic term to test for possible nonlinearity in the effect of working 'too many' hours (i.e. time scarcity only becomes a problem after some threshold), but there was no improvement on the model fit. Similarly, one's (dis)satisfaction with the amount of leisure (i.e. free) time also does not appear to be relevant. Part of this result might be explained by the incomplete nature of this variable, which may provide only a partial approximation to individual's experience of work-life balance. We would expect increasing dissatisfaction with leisure time to reflect issues of 'time scarcity' and 'time squeeze'; however, it is possible that individuals with objectively less discretionary time feel happy with the little amount of leisure time because they attribute more value to work time than to leisure time (Goodin et al., 2008).

Environmental self-perception

Model (2) adds our measure for individual's environmental self-perception to model (1), which includes only individual and household attributes and household location. Adding environmental self-perception to the model specification increases the adjusted explanatory power, which suggests there is some consistency between attitudes and actions (i.e. values help predict actions

at least to some extent). However, the increase in explanatory power is considerably larger in the case of the naïve PEB index (in Table 4), while it is fairly small for the GRM PEB index models (in Table 5). The difference in the increase in the adjusted explanatory power between the naïve index and the GRM index models can be explained by the fact that the GRM index already controls for the 'difficulty' and/or 'opportunity' of performing actions associated with pro-environmental behaviour, so any remaining association is more likely to be genuinely related to the explanatory variable (i.e. environmental self-perception). In both cases, the model parameters indicate that the stronger the individual's self-perception that his or her lifestyle is environmentally friendly, the higher the score of the PEB index. This result is sensible since individuals who perceive themselves as doing more things (in general) that are environmentally friendly are expected to score higher values in the PEB index.

Individual and household demographic and socio-economic attributes

Overall, the score of the PEB index increases with age, that is, on average reported pro-environmental behaviour (based on the 21 activities in Table 1) becomes *greener* as people grow older, *ceteris paribus*. The pattern of the effect is not exactly the same between the naïve and GRM indices: the effect of age is highest for individuals aged 65 years or more in the case of the naïve PEB index, while it is highest for individuals aged 45-54 years in the case of the GRM PEB index.

In both the naïve and GRM models, there are no statistically significant gender differences in pro-environmental behaviour, except for model (5) which accounts for intra-household partner effects. Model (5) suggests that once we include the partner's PEB index score as an additional regressor, women have on average higher scores than their male partners. This indicates that if we consider couple's behaviour, women appear to act more pro-environmentally than their male partners.

Both the naïve and GRM models suggest that differences between part-time workers and full-time workers are not statistically significantly different from zero. Chai et al., 2015 measured discretionary time availability with an indicator of working regime, i.e. part-time or full-time, to test for the moderator effect of work-life balance on the value-action gap. We believe this is a poor proxy for experienced work-life (im)balance, be it objective or subjective.

In both the naïve and GRM models, there is a positive relationship between educational attainment and pro-environmental behaviour. The PEB index score is highest for individuals with a university degree and lower for individuals with lower levels of education. Although there are some differences in the level of statistical significance between the naïve index and GRM index models, the overall pattern is the same for both indices, which is reassuring and in line with the expectation that more educated people are likely to behave more pro-environmentally, other things being the same.

Interestingly, and as expected, higher household income tends to be associated with lower scores of the pro-environmental behaviour index. However, the coefficient is only statistically significant in the models using the naïve PEB index (i.e. Table 4). According to these models, a 10% increase in household income is associated with a reduction in the naïve PEB index score of about 0.09 points. This result is in agreement with the expectation of higher consumption levels for individuals and

households with higher income levels, which in turn is likely to be associated with lower PEB scores. The precise effect will of course differ across households depending on, for example, their attitudes towards the environment (this seems to be the case since adding the measure for environmental self-perception in model (2) reduces the size of the income effect). As for the non-significant effect of income in the GRM models in Table 5, this can be explained by the fact that GRM places greater weight on activities which do not rely on (or are not related to) higher incomes; this is an aspect of the "difficulty" (or "lack of opportunity") of performing actions associated with pro-environmental behaviour, and the GRM index is estimating a score which is indicative of pro-environmental behaviour having been 'corrected' in some sense for difficulty/opportunity.

The models also indicate that pro-environmental behaviour differs significantly between types of households, and in particular with the presence of young children (i.e. between 0-5 years old). Although there are some differences in the level of statistical significance between the naïve index and GRM index models, the overall trend is similar for both indices. The score of the naïve PEB index (in Table 4) is lower for households with young children (between 0-5 years old), particularly single households. The GRM models (in Table 5) suggest that couples without children and with older children have higher PEB index scores than couples with younger children (0-5 years old) or single-person households. This seems reasonable since we would expect that the difficulty (indicated by the time demanded) in performing pro-environmental behaviours, all other factors remaining the same, is smaller for couples without children and with older children, compared to households with young children or single-person households (because of no sharing between tasks such as, for example, recycling).

Household residential location

Differences in local area infrastructure (e.g. transport network, recycling facilities, etc.) and procedures may also affect the uptake of pro-environmental behaviour by individuals and households. We have included control variables for Local Authorities to account for possible sources of variation arising from spatial heterogeneity. The test for joint-significance suggested there are statistically significant differences across local authorities. In addition to these control variables, we also included a measure for the degree of urbanisation of households' residential location (rural, small town, urban) to account for a more localized effect of urban density. Once we control for local authorities and the other demographic and socio-economic factors in the models, the differences in pro-environmental behaviour of households living in rural areas, small towns and urban areas are not statistically significant. This result is in contrast with the generalised perception that carbon footprints are greater for rural households compared to more urban households. Although this may indeed be true for some specific domains (e.g. mobility and household energy consumption), it may not necessarily be the case if we consider a more comprehensive range of behaviours as is the case in this study.

Intra-household spillover effects

Model (5) investigates the presence of intra-household spillover effects in pro-environmental behaviour by testing if and how one partner's PEB index score affects the other partner PEB index

score. Allowing for intra-household partner effects increases the explanatory power substantially, especially in the case of the GRM PEB index in table 5. The coefficient is strongly significant and positive, which indicates that partners tend to have similar levels of pro-environmental behaviour. This result can be indicative of positive assortative matching between partners (in pro-environmental attitudes and behaviour) or/and a result of peer pressure between partners.

5.2. Sensitivity analysis

Table 6 summarises the results obtained from the estimation of model (2), model (3) and model (4) for two separate individual pro-environmental behaviours with different time use intensities: (i) 'Walk or cycle for short journeys less than 2 or 3 miles' is selected to represent a time demanding behaviour, and (ii) 'Take your own shopping bag when shopping' is selected to represent a non-time demanding behaviour. As with the main analysis reported in tables 4 and 5, model (3) adds the measures of objective and subjective work-life balance to model (2), while model (4) further adds the interaction terms between environmental self-perception and the two measures of work-life balance.

Model (3) in Table 6 indicates that higher levels of dissatisfaction with the amount of leisure time (i.e. the proxy for subjective work-life balance) are associated with a reduction in the score of both pro-environmental behaviours, but the size of the effect is higher (in absolute terms) for the more time demanding behaviour. On the other hand, the coefficient for the objective measure of work-life balance is not statistically significant in the case of both behaviours. This provides some evidence in favour of a negative effect of "feeling" time squeezed or experiencing work-life imbalance, but not actual unallocated (i.e. free) time availability, on more time-demanding pro-environmental behaviours.

Model (4) adds the interaction terms and indicates that generally neither the subjective nor the objective measures of work-life balance appear to act as a moderator of the relationship between environmental self-perception and pro-environmental behaviour. There appears to be one exception for the measure of subjective work-life balance, which suggests that "feeling" time squeezed reduces the strength of the positive association between high environmental self-perception and pro-environmental behaviour: that is, it may increase the value-action gap for the more environmentally minded people (but not the less environmentally minded). Perhaps unexpectedly, this effect is statistically significant only for the less time demanding behaviour (i.e. 'take your own shopping bag when shopping'). Apart from this somewhat unexpected result, the findings suggest that subjective, and especially objective, work-life balance does not seem to affect the nature of the association between environmental self-perception and pro-environmental behaviour impact on the value-action gap.

Table 4. Results from regression models of naïve PEB index

Naïve PEB Index	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Age group (ref.: 15-24)					
25-34	0.0212**	0.0126	0.0115	0.0116	0.0117
35-44	0.0406***	0.0284***	0.0268***	0.0268***	0.0213*
45-54	0.0516***	0.0340***	0.0328***	0.0328***	0.0204*
55-64	0.0519***	0.0300***	0.0286***	0.0286***	0.0119
65+	0.0680***	0.0445**	0.0421**	0.0420**	0.0144
Female (ref.: male)	0.0058	0.0053	0.0050	0.0050	0.0175***
Part-time (ref.: full-time)	0.0059	0.0028	0.0027	0.0029	0.0067
Highest level of qualifications (ref.: degree)					
Other higher education qualification	-0.0325***	-0.0313***	-0.0317***	-0.0317***	-0.0155***
A levels	-0.0318***	-0.0264***	-0.0266***	-0.0266***	-0.0066
GSCEs	-0.0385***	-0.0315***	-0.0323***	-0.0322***	-0.0099*
Other qualification	-0.0545***	-0.0457***	-0.0463***	-0.0461***	-0.0165**
No qualification	-0.0395***	-0.0254**	-0.0255**	-0.0256**	-0.0050
Household income (in log)	-0.0094**	-0.0082*	-0.0088**	-0.0088**	-0.0006
Household type (ref.: Single, no children)					
Single, children 0-5	-0.0622*	-0.0505*	-0.0502*	-0.0505*	-
Single, children 5-15	-0.0076	-0.0131	-0.0126	-0.0125	-
Couple/adults, no children[1]	0.0047	0.0009	0.0013	0.0014	-
Couple/adults, children 0-5	-0.0046	-0.0043	-0.0039	-0.0037	-0.0029
Couple/adults, children 5-15	0.0057	0.0040	0.0048	0.0049	-0.0016
Household residential location (ref.: village, rural)					
Urban	0.0044	0.0013	0.0001	-0.0000	0.0061
Small town	0.0107	0.0092	0.0079	0.0081	0.0147*
Wave (ref.: wave 1)					
wave 4	-0.0245***	-0.0254***	-0.0258***	-0.0259***	-0.0123***
Environmental self-perception (ref.: low)					
Medium	-	0.0472***	0.0472***	0.0592**	0.0274***
High	-	0.0851***	0.0851***	0.0809*	0.0473***

Naïve PEB Index	**Model (1)**	**Model (2)**	**Model (3)**	**Model (4)**	**Model (5)**
Satisfaction with leisure time (trend)	-	-	-0.0008	-0.0011	-0.0007
Environmental self-perception (medium) X satisfaction with leisure time	-	-	-	0.0009	-
Environmental self-perception (high) X satisfaction with leisure time	-	-	-	-0.0004	-
Unallocated time (in log)	-	-	-0.0007	0.0017	0.0025
Environmental self-perception (medium) X Unallocated time	-	-	-	-0.0070	-
Environmental self-perception (high) X Unallocated time	-	-	-	0.0024	-
Partner's PEB index	-	-	-	-	0.5997***
Constant	0.4359***	0.4106***	0.4218***	0.4172***	0.1183***
Dummy variables for local authorities	YES	YES	YES	YES	YES
Observations	4465	4353	4340	4340	2999
LR test			4.11 (0.5343)		
R^2	0.264	0.326	0.326	0.327	0.643
Adjusted R^2	0.200	0.265	0.266	0.265	0.598

* Significant at 10%, ** significant at 5%, *** significant at 1%.

[1] baseline for model (5).

Table 5. Results from regression models of GRM PEB index

GRM PEB Index	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Age group (ref.: 15-24)					
25-34	0.0033	0.0006	-0.0009	-0.0010	-0.0004
35-44	0.0261**	0.0210*	0.0185	0.0184	0.0024
45-54	0.0423***	0.0334***	0.0318***	0.0318***	0.0018
55-64	0.0357***	0.0254*	0.0241*	0.0241*	-0.0018
65+	0.0396*	0.0277	0.0243	0.0244	-0.0007
Female (ref.: male)	0.0057	0.0044	0.0039	0.0039	0.0078***
Part-time (ref.: full-time)	-0.0042	-0.0067	-0.0065	-0.0066	0.0022
Highest level of qualifications (ref.: degree)					
Other higher education qualification	-0.0259***	-0.0249***	-0.0257***	-0.0258***	-0.0022
A levels	-0.0229***	-0.0191***	-0.0192***	-0.0193***	-0.0011
GSCEs	-0.0305***	-0.0260***	-0.0267***	-0.0267***	0.0008
Other qualification	-0.0509***	-0.0452***	-0.0458***	-0.0458***	0.0013
No qualification	-0.0399***	-0.0316**	-0.0315**	-0.0316**	-0.0049
Household income (in log)	0.0045	0.0045	0.0031	0.0031	-0.0008
Household type (ref.: Single, no children)					
Single, children 0-5	-0.0451	-0.0372	-0.0365	-0.0363	-
Single, children 5-15	-0.0073	-0.0119	-0.0112	-0.0113	-
Couple/adults, no children[1]	0.0178*	0.0150*	0.0160*	0.0159*	-
Couple/adults, children 0-5	-0.0119	-0.0101	-0.0092	-0.0094	-0.0019
Couple/adults, children 5-15	0.0187*	0.0183*	0.0201**	0.0200**	-0.0011
Household residential location (ref.: village, rural)					
Urban	-0.0006	-0.0016	-0.0024	-0.0023	0.0029
Small town	-0.0006	-0.0031	-0.0045	-0.0046	0.0009
Wave (ref.: wave 1)					
wave 4	-0.0373***	-0.0377***	-0.0381***	-0.0380***	-0.0016*
Environmental self-perception (ref.: low)					
Medium	-	0.0331***	0.0333***	0.0261	0.0054***
High	-	0.0542***	0.0552***	0.0774	0.0067***

GRM PEB Index	**Model (1)**	**Model (2)**	**Model (3)**	**Model (4)**	**Model (5)**
Satisfaction with leisure time (trend)	-	-	0.0002	0.0004	-0.0001
Environmental self-perception (medium) X satisfaction with leisure time			-	-0.0003	-
Environmental self-perception (high) X satisfaction with leisure time			-	-0.0004	-
Unallocated time (in log)	-	-	-0.0022	-0.0022	0.0004
Environmental self-perception (medium) X Unallocated time	-	-	-	0.0038	-
Environmental self-perception (high) X Unallocated time	-	-	-	-0.0095	-
Partner's PEB index	-	-	-	-	0.9828***
Constant	0.4769***	0.4848***	0.5021***	0.5020***	0.0103
Dummy variables for local authorities	YES	YES	YES	YES	YES
Observations	4465	4353	4340	4340	2495
LR test			7.21 (0.2121)		
R2	0.338	0.353	0.353	0.353	0.985
Adjusted R2	0.280	0.295	0.295	0.294	0.982

* Significant at 10%, ** significant at 5%, *** significant at 1%.

[1] baseline for model (5).

Table 6. Results for most and least time demanding pro-environmental behaviours using the Naïve PEB index

	Walk or cycle for short journeys less than 2 or 3 miles			Take your own shopping bag when shopping		
	Model (2)	**Model (3)**	**Model (4)**	**Model (2)**	**Model (3)**	**Model (4)**
Age group (ref.: 15-24)						
25-34	-0.1126	-0.1175	-0.1179	0.6690***	0.6608***	0.6632***
35-44	-0.2219*	-0.2187*	-0.2188*	0.9822***	0.9746***	0.9816***
45-54	-0.1519	-0.1463	-0.1461	1.1467***	1.1369***	1.1407***
55-64	-0.2574**	-0.2601**	-0.2604**	1.2721***	1.2577***	1.2566***
65+	-0.0661	-0.0581	-0.0575	1.6353***	1.5767***	1.5682***
Female (ref.: male)	-0.2262***	-0.2212***	-0.2212***	0.5329***	0.5318***	0.5354***
Part-time (ref.: full-time)	0.1204**	0.1253*	0.1243*	0.1615**	0.1185*	0.1247*
Highest level of qualifications (ref.: degree)						
Other higher education qualification	-0.1782**	-0.1729**	-0.1731**	-0.2161***	-0.2243***	-0.2241***
A levels	-0.0568	-0.0540	-0.0544	-0.2664***	-0.2699***	-0.2683***
GSCEs	-0.1019	-0.1006	-0.1011	-0.2438***	-0.2511***	-0.2525***
Other qualification	-0.1159	-0.1157	-0.1160	-0.3038***	-0.3068***	-0.3005***
No qualification	0.0256	0.0339	0.0339	-0.3750***	-0.3640***	-0.3655***
Household income (in log)	-0.1816***	-0.1868***	-0.1872***	-0.0275	-0.0220	-0.0204
Household type (ref.: Single, no children)						
Single, children 0-5	-0.1911	-0.1823	-0.1813	-0.5321	-0.5217	-0.5414
Single, children 5-15	0.0476	0.0660	0.0644	-0.2660*	-0.2583*	-0.2619*
Couple/adults, no children	-0.0538	-0.0496	-0.0504	0.1947**	0.1896**	0.1910**
Couple/adults, children 0-5	-0.0125	0.0085	0.0060	0.2118*	0.2122*	0.2117*
Couple/adults, children 5-15	0.0073	0.0233	0.0221	0.0714	0.0698	0.0677
Household residential location (ref.: village, rural)						
Urban	0.3356***	0.3333***	0.3335***	0.1935*	0.1892*	0.1808*
Small town	0.5220***	0.5246***	0.5232***	0.2144	0.2094	0.2045
Wave (ref.: wave 1)						
wave 4	-0.1025***	-0.1006***	-0.0998***	-0.0415	-0.0458	-0.0432
Environmental self-perception (ref.: low)						

	Walk or cycle for short journeys less than 2 or 3 miles			Take your own shopping bag when shopping		
	Model (2)	**Model (3)**	**Model (4)**	**Model (2)**	**Model (3)**	**Model (4)**
Medium	0.2051***	0.1985***	0.1708	0.3977***	0.3949***	0.8831**
High	0.4654***	0.4451***	0.6130	0.6156***	0.6021***	0.2661
Satisfaction with leisure time (trend)	-	-0.0402***	-0.0349*	-	-0.0254*	0.0014
Environmental self-perception (medium) X satisfaction with leisure time	-	-	-0.0101	-	-	-0.0369
Environmental self-perception (high) X satisfaction with leisure time	-	-	-0.0055	-	-	-0.0904**
Unallocated time (in log)	-	-0.0617	-0.0630	-	0.1008	0.1225
Environmental self-perception (medium) X Unallocated time	-	-	0.0296	-	-	-0.1619
Environmental self-perception (high) X Unallocated time	-	-	-0.0674	-	-	0.2928
Constant	2.5337***	2.8192***	2.8102***	0.5887	0.4368	0.2710
Dummy variables for local authorities	YES	YES	YES	YES	YES	YES
Observations	4353	4340	4340	4352	4339	4339
R2	0.224	0.226	0.226	0.265	0.266	0.268
Adjusted R2	0.155	0.155	0.155	0.199	0.200	0.201

* Significant at 10%, ** significant at 5%, *** significant at 1%.

6. Conclusion

This study estimated regression models using individual and household microdata from the UK Household Study (UKHLS) to investigate the relationship between pro-environmental behaviour, environmental self-perception, and work-life balance. The analyses also investigated the presence of intra-household spillover effects in pro-environmental behaviour, which were found to be positive and strong. We defined two alternative composite indices to measure pro-environmental behaviour - the naïve index and the Graded Response Model (GRM) index - capturing behaviours across multiple domains (e.g. home energy, personal transport, recycling, shopping), habitual vs. one-off behaviours, and with differing degrees of environmental impact. The main advantage of a naïve index is its relative simplicity of computation and interpretation; its main limitation is attributing equal weight to all behaviours, while the GRM pro-environmental behaviour index overcomes this limitation by estimating behaviour-specific weights from the data. We represent work-life balance in relation to the actual time spent on paid work vs. non-paid work activities (objective measure) and individuals' level of satisfaction with the amount of leisure time available (subjective measure).

The results indicate there is a strong relationship between one's environmental self-perception (about overall lifestyle) and pro-environmental behaviour. Differences in individual and household socio-economic and demographic attributes, notably age, educational attainment, income, and the presence of young children) also help explain the differences in the scores of the pro-environmental behaviour indices. However, we did not find a statistically significant relationship between the subjective and objective measures of work-life balance and pro-environmental behaviour: that is, working too many hours and feeling dissatisfied with the amount of leisure time does not appear to impact on individuals' pro-environmental behaviour. Similarly, work-life imbalance does not appear to affect the relationship between environmental self-perception and pro-environmental behaviour. The sensitivity analysis considered separate models for two typical more time demand and less time demanding behaviours, respectively. The results revealed that feeling more dissatisfied with the amount of leisure time available (i.e. subjective work-life balance) can have a negative direct effect on the uptake of pro-environmental behaviours, particularly for more time demanding behaviours. In contrast, the actual availability of discretionary time (i.e. objective measure of work-life balance) did not seem to impact on either type of pro-environmental behaviour (i.e. more or less time demanding behaviour). The results from the sensitivity analysis for the effect of work-life balance on the value-action gap suggest that generally neither the subjective nor the objective measures of work-life balance appear to act as a moderator of the relationship between environmental self-perception and pro-environmental behaviour. This evidence was again stronger for the objective measure of work-life balance.

Our findings have implications for the design of policies aiming to target pro-environmental behaviours by promoting a better balance between work commitments and non-work commitments involving spending time with family, friends, and the wider community. According to our study, simply reducing the number of working hours (e.g. through labour legislation and/or organisational change) to improve work-life balance is not likely to increase (or decrease) the uptake of pro-environmental behaviours. Similarly, while flexible working arrangements may have some (limited) effect on the adoption of more sustainable behaviours, a more important focus may be to

ensure that such arrangements are designed in a way that helps individuals to cope psychologically and emotionally with feelings of time pressure and overworking. Although such measures may contribute to increased individual well-being and life satisfaction, our findings do not support the view that pro-better work-life balance measures can be an effective way to help individuals behave more pro-environmentally, even more environmentally minded individuals.

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